

Berkeley Experiments with Accelerated Radioactive Species

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Berkeley Experiments with Accelerated Radioactive Species, or BEARS, is an initiative to develop a radioactive ion-beam capability at the 88" Cyclotron using isotopes produced at the Biomedical Isotope Facility (BIF) of the Life Sciences Division [1,2]. Activity is to be transported from BIF in building 56 to the 88" Cyclotron via a 300-m gas-capillary transport line (Figure 1). BIF can produce several light isotopes of interest, including ^{13}N and ^{17}F , although initial development has focussed mainly on ^{11}C and, to a lesser extent, ^{14}O .

Considerable development on the BEARS project occurred during 1998. Initial attempts to transport ^{11}C via aerosols and inject them directly into the 88" Cyclotron's ECR ion source [2,3] lead to only very low beam intensities. Cryogenic trapping, where ^{11}C - and ^{14}O -labelled gases such as $^{11}\text{CO}_2$ are frozen out of the nitrogen target/transport gas then released directly into the ion source, was found to be a much more effective technique [2]. This method had the further advantages of allowing simple, maximum-yield production at BIF and of being easily adapted to the 88" Cyclotron's more advanced and capable ion source, the AECS-U, which has very high efficiencies for ionization to high charge states.

Prior to completion of the 300-m transfer line, 20-min half-life ^{11}C activity has been transferred between the two buildings in a hand-carried, lead-shielded cryogenic trap. Although this procedure only allowed for about 10 or 20 minutes of supplied ^{11}C in any one period of about hour or more, it led to the first beams of ^{11}C accelerated at the 88" Cyclotron. Beams of a few times 10^7 were routinely achieved and were used in an initial experiment, a measurement of the production cross sections of astatine isotopes in the reaction of ^{11}C on gold. Results of the tests,

and of the first experiment, are described in other submissions to this report [4,5].

The transfer line between buildings 56 and 88 was partially built in 1998, with a PVC pipe laid along the side of Blackberry canyon. In spring of 1999, this will be continued under the road and parking lot to building 56. This outer pipe is for protection from the elements. Within it, the gas transport capillaries will be contained inside a 2" diameter vacuum hose. The presence of vacuum in the hose serves to verify the physical integrity of the transfer line and prevents any release of activity.

The complete BEARS system should be completed and operational by summer, 1999, with projected ^{11}C and ^{14}O beams of 2×10^8 and 1×10^6 ions/sec, respectively [2].

Footnotes and References

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1. <http://cerny3.lbl.gov/BEARS/homepage.html>
2. J. Powell, et al., Proceedings of CAARI'98, Denton, Texas, Nov. 4-7, 1998.
3. D. M. Moltz, et al., "BEARS: Radioactive Ion Beams at LBNL", NSD Annual Report 1998.
4. P. McMahan, et al., in this report.
5. R. Joosten, et al., in this report.

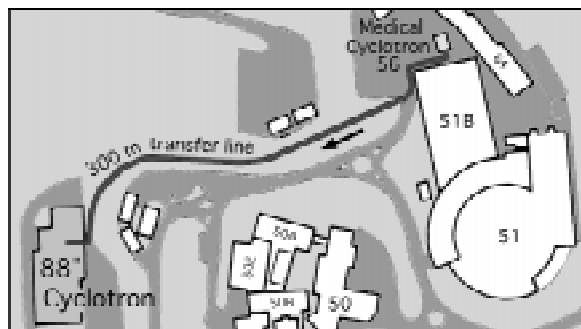


Figure 1. BEARS transfer line currently under construction between buildings 56 and 88.